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RAZVEDENIE TIKHOOKEANSKIKH LOSOSEI V SAKHALINSKOI OBLASTI

THE REARING OF PACIFIC SALMON IN THE PROVINCE OF SAKHALIN

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The province of Sakhalin is the main region of commercial salmon rearing in the Far East. There are seventeen fish culture enterprises here with a rated capacity of over 650 million juvenile fish that provide for a release of the order of 250 million chum and 400 million pink salmon. Three centers have been established for the propagation of these species, viz. south-eastern Sakhalin with the release of about 80 million young chum, the south-eastern coast of the island, where the average release figure approaches 200 million downstream-migrants and the Iturup Island, where fish culturists assure a release of the order of 160 million pink salmon fingerlings.

The Ado-Tymovskii fish-rearing station. Located at the Rybovodnyi creek that empties into the Tym' River 170 km from its estuary. In operation since 1928. It is a warm-water hatchery. The rated capacity of the hatchery with regard to the release of juvenile fish under the existing biotechnical normes regulating the rate of exploitation is of 42.6 million fingerlings. The reproduction of chum salmon in the Tym' River basin is of a mixed character, i.e. the catch depends on both the yield to the fishery of fish migrating from the natural spawning grounds and of fish released by hatcheries.

The Pobedinskii fish-rearing station. In operation since 1925. Located in the Poronai River basin at the left affluent of the Zhitnitsa River. River length - 61 km, water-basin area - 510 km^2. The hatchery po-

pulation of chum is made up by specimens entering the Rybovodnyi brook that empties into the Poronai River a little further upstream from the Zhitnitsa River. With regard to the water supply, it is a warm-water hatchery, since ground water is the source of its water intake. In winter, however, the water passing through a small lake in front of the hatchery is cooled considerably - down to 1.6°C.

The lack of a definite orientation toward rearing one or another /2
species of salmon characterizes the activity of this enterprise. In recent years, the hatchery has incubated basically pink salmon eggs in odd years and, therefore, the release of chum (1982, 1984, 1986) has been insignificant. In even years, on the contrary, while the yield to the fishery of pink salmon is low, chum eggs are incubated and, therefore, the release of chum in odd years was considerably higher (1983, 1985, 1987).

The rated capacity of this hatchery, as far as the release of young salmon is concerned, is small - 14.4 million fingerlings.

The Buyuklovskii fish-rearing station. It was built in 1924 and the first juvenile chum salmon were released from it in 1925. It is located in the Poronai River basin on the Buyuklinka River - its right tributary. It is a warm-water hatchery utilizing ground water. The hatchery covers 1150 m^2 and is capable of keeping 28.8 million chum larvae. In odd years, chum made up the bulk of fish reared here (1981, 1979), while in even years it was pink salmon in view of the fact that it was numerous in the previous year and it was mostly pink salmon eggs that were incubated. Since 1938 this hatchery has been rearing basically chum salmon.

The Pugachevskii fish-rearing station. Located on the south-eastern coast of Sakhalin. The release of juvenile salmon began in 1930. For the last 20 years its capacity has been of the order of 50 million downstream-migrants.

The Sokolovskii fish-rearing station. Located in the Naiba River basin on the Bol'shoi Takoi River - its left tributary. An intensive artificial culture of chum in this river took place in the 1950's and 1960's. The release of juvenile fish from the Sokolovskii and the nearby Bereznyakovskii hatcheries increased from 36 million in 1955 to 113

million in 1971. However, already toward the end of the 1960's these hatcheries began the incubation of pink salmon eggs, whereas in the early 1970's pink salmon became the main reproduction objective. /3

At the present time, the artificial culture of chum in the Naiba River basin takes place on a reduced scale in the 4th section of the hatchery at the Sokolovskii fish-rearing station. It is the only section where the temperature conditions satisfy the demands of chum during the period of embryogenesis. All the remaining sections utilize underground water intake and incubate pink salmon eggs.

The Bereznyakovskii fish-rearing station. Located in south-eastern Sakhalin in the Bol'shoi Takoi River basin - a tributary of the Naiba River. The rated release capacity of the Bereznyakovskii hatchery is of 45 million young fish. The station has been in operation since 1925. The original release volume amounted to one million chum fingerlings.

The Lesnoi fish-rearing station. Located in south-eastern Sakhalin. In operation since 1957. The original capacity was of 5 million. At present it produces 50 million juvenile pink salmon.

The Okhotskii fish-rearing station. Located in south-eastern Sakhalin in the basin of the Udarnitsa River that empties into Lake Tunaicha. Length of the river - 12 km, the basin area - 200 km^2. The artificial culture of chum at this enterprise extends from 1933 to the present time. It is a warm-water hatchery, the water temperature in the rearing section rarely dropping below $3^{\circ}C$. In the fall, from September to November, the temperature drops from 7.9 to $3.2^{\circ}C$, whereas in spring, from March to May, it rises from 3.7 to $6.9^{\circ}C$. The high temperature of water during the incubation of eggs and the keeping of larvae favors a rapid embryonal development of chum. During March to May the young fish are fed and, after reaching 600 to 1000 mg, they are released. The average weight of juvenile fish in 1979-1986 was 750 mg.

In the late 1970's and early 1980's, the release of juvenile chum from this hatchery fluctuated between 20.9 and 33.6 million. Renovation work started at this station in 1984 and the release of juvenile fish has dropped considerably. /4

The Anivskii fish-rearing station. Located in the Aniva Bay. In

operation since 1942. In the past 20 years it has increased its capacity from 9 to 20 million downstream-migrants.

The Taranaiskii fish-rearing station. Located in the Aniva Bay. In operation since 1939. During this period it has increased its capacity from 5 to 40 million fingerlings. In recent years, due to renovation work, the release figure at this enterprise has dropped to 20 million.

The Yasnomorskii fish-rearing station. Located in south-western Sakhalin, 8 km from the mouth of the Yasnomorka River. Built in 1923.

An intensive increase in the release of juvenile fish from this hatchery began in the second half of the 1950's. The figure in question grew from 3.5 million in 1957 to 16 million toward the end of the 1970's. The transportation of eggs at this enterprise was in use antil the mid 1970's.

During the 1980's the volume of eggs transported to the hatchery dropped substantially, nor was this practice resorted to during 1976-1979.

The Sokol'nikovskii fish-rearing station. Built in 1912 on the Zavetinka River, 8 km from its mouth. One section at this hatchery has a mixed water supply from the drainage system and the river.

The culture of chum at this station attained an intensive development in the early 1950's. The release of juvenile fish during the 1950's and 1960's, like at other hatcheries in the province of Sakhalin, grew in proportion to the volume of eggs incubated and the density of larvae planting in the hatchery, so that toward the end of the 1970's the annual release figure exceeded 20 million fingerlings.

Similar to the other stations, the Sokol'nikovskii hatchery resorted to the transportation of eggs. During the 1946-1985 period, 80 million chum ova were exported and 70 million imported, the bulk of it from the Kaininskii fish-rearing station. However, during the past fifteen years /5
practically no chum eggs coming from other stations were incubated, with the only exception of 1976 (9.7 million) and 1980 (12.3 million ova).

The Kalininskii fish-rearing station. Built in 1924 for the rearing of chum salmon. At present, the station has four hatchery sections. During the 1950's and 1970's there was a substantial increment in the rate of chum exploitation. Toward the end of the 1970's, the average annual catch of chum amounted to 260 000 specimens, exceeding by more than forty times the number of chum present in the river during the period of 1946-1950 (6 100 specimens).

In 1983, an abrupt drop in the number of chum occurred in the Kalininka River. The spawning part of the population amounted to only 65 000 specimens. In 1984, the figure was 17 000.

An evaluation of the artificial chum-salmon culture in south-western Sakhalin (the Yasnomorskii, Sokol'nikovskii, and Kalininskii fish-rearing stations) should mention that this is the main region for hatchery reproduction of this salmon species in the Sakhalin province. In the late 1970's, the chum release figure amounted here to 120 million fingerlings or more than 45% of the total number planted by the hatcheries.

The Urozhainyi fish-rearing station. Located in south-western Sakhalin. In operation since 1957. The release of juvenile salmon in this period increased from 3.7 to 10 million. In the past twenty years, from the total amount of eggs, viz. 154 million, used for incubation, 148.6 million, that is 96.5%, were brought from other regions.

The Ainskii fish-rearing station. In operation in south-eastern Sakhalin since 1925. In the past twenty years, its annual release of juvenile salmon was from 15 to 34 million. In the years when the number of pink salmon was low, the hatchery imported chum salmon eggs. In the past twenty years, 356 million or 84.8% of the total amount of 420 million eggs used for incubation were brought from other regions. The importation did not produce satisfactory results.

The Kuril'skii fish-rearing station. Located on the Iturup Island. /6
In operation since 1925. In the past twenty years, its capacity increased from 70 to 135 million juvenile fish. It rears pink salmon, although chum eggs were used for incubation in the years when the numbers of

pink salmon were low. This hatchery's share in the total crop of juvenile pink salmon in the Kuril'skii Bay has fluctuated between 44 and 89% in the past twenty years, amounting on the average to 81%.

The Reidovyi fish-rearing station. Located on the Iturup Island. The release of juvenile salmon began in 1961. During this period, it increased its capacity from 11 million to 78 million downstream-migrants. Chum eggs have been used periodically for incubation in the years when the number of pink salmon was low.

Figures relating to the release of juvenile Pacific salmon by each fish-rearing station for the past six years are shown in Table 1. Data on the total number of young fish released are contained in Table 2.

Table 1

Release of juvenile Pacific salmon by hatcheries in the province of Sakhalin in the past six years

Name of hatchery	1983		1984		1985		1986		1987		1988	
	Г	К	Г	К	Г	К	Г	К	Г	К	Г	К
Ado-Tymovskii	–	48,2	–	70,1	–	72,5	–	48,0	–	53,4	–	53,6
Pobedinskii	8,4	10,5	17,0	1,2	2,6	12,4	12,0	2,4	3,3	15,4	0,25	15,0
Buyuklovskii	0,7	21,6	–	37,7	0,4	36,7	10,8	24,4	–	34,7	–	36,5
Pugachevskii	37,0	–	56,5	–	0,38	–	47,4	–	0,4	–	19,7	–
Sokolovskii	47,0	62,3	78,0	20,8	21,2	45,3	69,6	3,5	0,9	21,7	36,6	18,0
Bereznyakovskii	51,0	32,4	75,0	–	15,02	–	49,0	–	5,9	–	46,6	–
Lesnoi	19,7	59,6	72,4	–	19,2	–	57,2	–	19,7	–	52,1	–
Okhotskii	–	30,9	–	18,9	–	4,6	–	5,9	–	6,4	–	18,4
Anivskii	13,7	8,2	18,8	–	19,2	–	18,7	–	19,0	–	18,6	–
Taranaiskii	7,6	25,4	28,6	–	11,0	0,4	34,7	–	18,4	0,8	21,9	3,7
Yasnomorskii	–	17,1	–	15,0	–	5,5	–	12,2	–	11,0	–	11,5
Sokol'nikovskii	–	24,3	–	13,4	–	3,6	–	15,6	–	13,9	–	13,3
Kalininskii	–	90,1	–	72,5	–	24,3	–	62,0	–	43,9	–	49,0
Urozhainyi	3,6	6,1	1,0	3,9	3,1	–	0,99	–	0,9	0,03	6,8	–
Ainskii	34,1	–	20,1	–	0,8	–	8,4	–	8,7	–	9,8	–
Kuril'skii	135,5	–	120,9	–	134,0	–	127,0	–	126,5	–	107,0	–
Reidovyi	83,2	2,8	78,2	–	32,2	45,0	68,9	3,7	74,2	16,7	75,6	–
	441,5	439,5	566,5	253,5	259,1	250,3	364,9	177,7	267,4	217,93	394,95	219,0

Г – pink salmon

К – chum

Table 2

Weight of released juvenile salmon, g

Name of hatchery	1983		1984		1985		1986		1987		1988	
	Г	К	Г	К	Г	К	Г	К	Г	К	Г	К
1. Ado-Tymovskii		0,40		0,36		0,50		0,54		0,54		0,56
2. Pobedinskii	0,27	0,33	0,23	0,35	0,30	0,60	0,30	0,56	0,23	0,55	0,22	0,56
3. Buyuklevskii	0,26	0,39	0,29	0,66	0,24	0,55	0,26	0,52	–	0,50	–	0,55
4. Pugachevskii	0,2I	–	0,2I	–	0,20	–	0,20	–	0,22	–	0,22	–
5. Sokolovskii	0,22	0,35	0,2I	0,5I	0,22	0,4I	0,25	0,55	0,22	0,6	0,25	0,52
6. Bereznyakovskii	0,25	0,32	0,I9	–	0,20	–	0,2I	–	0,22	–	0,25	–
7. Lesnoi	0,24	0,35	0,24	–	0,23	–	0,22	–	0,28	–	0,23	–
8. Okhotskii	–	I,0	–	0,7	–	0,7	–	0,9	–	I,I	–	0,99
9. Anivskii	0,23	0,35	0,22	–	0,25	–	0,24	–	0,22	–	0,23	–
10. Taranaiskii	0,22	0,39	0,23	0,34	0,24	0,32	0,22	–	–	0,77	0,26	0,82
11. Yasnomorskii	–	0,39	–	0,44	–	0,50	–	0,7I	–	0,6I	–	0,6I
12. Sokol'nikovskii	–	0,55	–	0,56	–	I,0	–	0,94	–	I,0	–	I,0
13. Kalininskii	–	0,5	–	0,7	–	0,95	–	0,86	–	0,9	–	0,9/0,6
14. Urozhainyi	0,24	0,38	0,24	0,34	0,24	–	0,28	–	0,3	0,4	0,26	Section 4
15. Ainskii	0,23	–	0,23	–	0,24	–	0,24	–	0,22	–	0,3I	–
16. Kuril'skii	0,23	–	0,2I	–	0,22	–	0,23	–	0,22	–	0,22	–
17. Reidovyi	0,22	0,49	0,22	–	0,2I	0,6	0,23	0,52	0,26	0,55	0,24	–

Г – pink salmon

К – chum